INEEL Large-Scale Demonstration Project

Test Plan for the Demonstration of the Electromagnetic Radiography Equipment

February 1999

1.0 Introduction

This field demonstration of the Electromagnetic Radiography (EMR) is part of a larger series of demonstrations executed under the Large Scale Demonstration and Deployment Project (LSDDP) funded by the Department of Energy (DOE) Environmental Management (EM)-50. The primary purpose of the LSDDP is to demonstrate innovative technologies on a large-scale basis in conjunction with Decommissioning and Dismantlement (D&D) activities. The innovative technologies demonstrated are compared against DOE's baselines and/or industrial baseline technologies in the relevant areas.

The first objective of the LSDDP is to identify existing technologies unproven in D&D applications that address the defined problems or needs of DOE D&D activities. The second objective is to quantify and document the benefits, if any, that can be realized from a side by side comparison of the innovative and baseline technologies. Possible benefits include cost reduction, exposure reduction, safety improvements, application ease, and improved performance. This direct comparison provides an opportunity to assess the impact of the innovative technology against the baseline and validate the benefits to be gained.

This demonstration, a field-screening scenario, will provide quantifiable data regarding buried utilities and interferences at the Idaho Nuclear Technology and Engineering Center (INTEC). We will also attempt to determine whether or not the railroad bed between Test Area North (TAN) and the Initial Engine Test (IET) facility contains mercury contamination, and we will investigate an old fuel transfer station at IET that may have a fuel oil spill plume. The proposed EMR technology, is a next generation higher power ground penetrating radar system. It will offer better resolution and detection capabilities for buried utilities and interferences. It will also provide feedback on types and concentrations of soil contaminants. The baseline technologies for utility location and soil contamination determinations are Ground Penetrating Radar (GPR), HazCat kits, and bore sampling with laboratory sample evaluation. The ability to detect soil contaminates before soil sampling will enable the reduction in the number of necessary samples and increase their accuracy. Allowing D&D to determine contamination levels for turn over to Environmental Restoration quicker and safer. Currently the turn around time for soil samples (baseline method) that are sent to the lab for characterization is a minimum of ninety days and typically longer. The EMR results should be available three weeks after completion of the data gathering. Due to increased resolution and reliability of the images provided by the EMR, excavation activities in and around D&D sites will be safer. Personnel Protective Equipment (PPE) requirements utilizing the EMR will be significantly reduced because the equipment is passed over the soil surface with minimal soil disturbance. Due to reduction in required PPE, sampling, soil removal and laboratory time, the EMR technology could significantly shorten the time it takes to characterize potential soil contamination areas. This will result in lower sampling costs, reduced employee exposures, and shorter D&D schedules.

1.1 Purpose

The purpose of this field demonstration is to assess the effectiveness of the EMR in detecting and providing the quantitative measurement of buried utilities and interferences along with the detection of soil contamination within INTEC, and IET. The EMR antenna to be used is within the 120-megahertz range with a much higher decibel gain than current GPR units. Also unique to this system is the post processing software that utilized by Mission Research Corporation to analyze the data. The deliverable derived from the EMR is three-dimensional data to characterize underground target geometry.

Mission Research Corporation will operate the EMR equipment. Mission Research Corporation provides the EMR equipment as a service contract. At this time the equipment is not available for purchase, rental, etc. They will perform these services upon request and issuance of a service contract. This demonstration is planned for one day at each site with the data post processing to occur at MRC's facilities in Albuquerque. The preliminary report is due by May 31, 1999. The final results are to be received by June 11, 1999.

1.2 Scope

The first part of the demonstration, looking for soil contamination, will be performed at the IET facility at the INEEL. The IET facility consists of several buildings and structures both above and below ground level. There is an old railroad bed, approximately one-mile long, which connected IET to TAN, and a diesel and jet fuel transfer station located at IET.

The second part of this demonstration, looking for buried utilities, will be performed at INTEC. INTEC's focus is on receiving/storing spent nuclear fuels and radioactive wastes, treating/converting wastes, and developing new technologies for waste and waste management.

The demonstration at INTEC will include an area, East and South of building 601 (approx. 60,000 sq. ft, see photo's 1 & 2). For the area around building 601. The old railroad bed (approx. 10,000 sq. ft, see photo 4) within the IET fenced area, a potential diesel fuel spill area (approx. 10,000 sq. ft, see photo 3) within the IET area. A grid based on the dimensions of the antenna to be used and the minimum size of object to be located will be setup and the entire area of that grid will be passed over by the antenna. This is the typical method for both the new technology and the GPR technology. For areas at IET the baseline technology is soil sampling this is accomplished by taking a certain number of samples

within a given area and then extrapolating the data across the total area. Depending on the type of contaminants, we are looking for, a statistical grid is set up across the area for the sampling activities.

The baseline GPR surveys of the area at INTEC have been completed. Confirmatory sampling locations and activities at IET will be based on the EMR survey results. The EMR results for INTEC will be compared to the existing utility drawings and GPR data.

Organizational Structure and Key Personnel

The DOE is supporting the demonstration of this technology. The Technology Development Department (TDD) has the primary responsibility for implementing the field demonstration. Table 1. below lists key personnel, including primary and secondary alternates, associated with the execution of this field demonstration.

Table 1. Key Project Personnel

Project Specific Title	Name	Phone Number	E mail
Project Manager	Dick Meservey	(208) 526-1834	Rhm@inel.gov
Mechanical Engineer	Larry Whitmill	(208) 526-0357	Wit@inel.gov
D&D Manager	Brad Frazee	(208) 526-3775	Bjf@inel.gov
Facility Manager	Harold Thorne	(208) 526-8078	Hlt@inel.gov
Test Engineer	Mark Kraft	(208) 526-6116	Mmk@inel.gov
Data Collector	Vince Daniel	(208) 526-5738	Ved@inel.gov
Planner	Mark Kraft	(208) 526-6116	Mmk@inel.gov

2.0 Field Analysis Program

The field analysis phase of this project will follow the evaluation of the baseline activity. This analysis will not impact the overall D&D schedule being conducted by the INEEL.

2.1 Baseline Technologies

Current methods of locating buried utilities and interferences include GPR and Radio detection equipment (This equipment is currently owned by the INEEL and operated by site personnel). Drawings are pulled for the area in question and the results are compared. Due to equipment limitations, 100% accuracy is not possible. Soil contamination and characterization technologies for diesel and metallic mercury are HazCat kits used for field screening and bore sampling activities utilized for lower levels of detection. HazCat kits are used for field sampling to give an immediate indication as to whether or not threshold quantities of Mercury or diesel exist, for example above or below 50 parts per million (PPM). This provides a rough basis for determining if the soil contamination is below required limits. Samples are then take and sent out to independent laboratories for confirmatory analysis. The turn around time for soil samples at the independent laboratories are typically ninety days and depending on the type of analysis required can be longer.

2.2 EMR Operation

The demonstration at INTEC will include an area, East and South of building 601 (approx. 60,000 sq. ft, see photo's 1 & 2). For the area around building 601. The old railroad bed (approx. 10,000 sq. ft, see photo 4) within the IET fenced area, a potential diesel fuel spill area (approx. 10,000 sq. ft, see photo 3) within the IET area. A grid based on the dimensions of the antenna to be used and the minimum size of object to be located will be setup and the entire area of that grid will be passed over by the antenna. This is the typical method for both the new technology and the GPR technology. For areas at IET the baseline technology is soil sampling this is accomplished by taking a certain number of samples within a given area and then extrapolating the data across the total area. Dependent on the type of contaminants being looked for a statistical grid is set up across the area for the sampling activities.

2.3 Measurements and Observations

Two test areas will be will be analyzed at the IET facility with the EMR equipment. Baseline sampling locations will be determined by the EMR survey results. Samples will be collected, by either HazCat Kits or for the Contract Laboratory Program (CLP), to compare to the EMR results. The samples as necessary will be removed and sent to an approved laboratory for mercury and diesel fuel analysis. The CLP sample program will be utilized in this situation as an independent verification that the contaminants have been remove to acceptable levels. One test area will be analyzed within the INTEC facility. Baseline surveys for buried utilities, ranging for 1 inch in diameter to 10 inches in diameter, around building

601 have been completed with findings staked, surveyed and mapped. These results will be compared with the EMR data.

3.0 Demonstration Schedule and Resource Requirements

The vendor will transport the EMR instrumentation to INTEC and IET at the INEEL.

The activities for the demonstration include:

- setting up equipment in demonstration areas,
- collecting data,
- collecting still photos and video tape,
- tear down and relocating the equipment to new test sites, and
- analysis of collected data.

4.0 Disposition of Demonstration Derived Wastes

The only potential waste generated by the demonstration will be Personal Protective Equipment (PPE) if required. Any dispositioning or disposal of soil samples shall be performed as indicated in the IET project plan.

5.0 Data Collection Requirements

A test engineer and a data collector will maintain detailed field notes regarding the field implementation and execution of this demonstration. Additional information will be collected on total survey times and environmental conditions prior to, during, and following the execution of the project. These field notes will be collected in hardbound logbooks.

5.1 Data Collected During EMR Demonstration

The data collector and the test engineer will record the following information during the EMR demonstration:

- vendor mobilization (time, transportation of personnel and equipment, equipment required, and training)
- Plan of the Day/Safety Meetings
- Donning PPE, if required
- Basic description of soil type at each test area
- Equipment setup and calibration time
- Number and type of people required to complete the job

- Time required to complete survey setup (grid layout), surveying/data recording activities
- Packing and unpacking equipment to transport from one work area to the next
- Equipment Decontamination
- Doffing PPE, if required
- Data reduction(analysis) time/report writing
- Demobilization (transport back to vendor's home)Video shots, still photo shots of area geology, equipment, actual testing activities, and any significant observations before, during, and after the EMR activity in the test area
- Activities time logged
- Debriefing and lessons learned

6.0 Training Requirements

The training requirements for the demonstration are listed below in Table 2. Vendors are to provide proof of training to the test engineer prior to demonstration.

Table 2. Personnel Training Requirements

Company	Individual	Requirements
INEEL	HP, RCT, and IH	RAD Worker II, 24 Hour HAZWOPER,
	Test Engineer and Data Collector	RAD Worker II, 24 Hour HAZWOPER
	IET Support Personnel	RAD Worker II, 24 Hour HAZWOPER
Mission Research Corporation	Personnel required to enter the test area	Site Access
Observers		Site Access

7.0 Costs

The overall costs associated with the baseline survey around building 601 are as shown in table 3. A more detailed cost breakdown will be provided for cost estimating purposes.

Table 3. Building 601 survey using existing technologies				
Number of INEEL employees	**Type of employee**	**Type of work**	**INEEL equipment**	**Hours to complete**
2	Surveyor & Engineer	Drawing search	INEEL drawings	12
2	Surveyors	Layout of known utilities, mapping of GPR findings	Standard Surveying equipment	40
2	Technician & Engineer	GPR Survey	GPR equipment	45

Currently, the vendor provides the service of the EMR. The cost of transporting, equipment setup, calibration, data recording, equipment tear down, transportation, training of personnel, and any preparation work will be recorded in the logbook.

Cost data will be initially recorded by means of a continuous time log. The Standard Cost Data Collections forms will subsequently be completed from that data. The vendor was required to provide specific information about the cost to use their services. These costs are part of the contract with the vendor and will be used in the subsequent cost analysis for the ITSR.

8.0 Health and Safety all personnel will be briefed on general safety procedures specific to conducting the EMR Demonstration. The test engineer will obtain permits (safe work permit, radiological work permit, etc.) from the safety personnel at the IET facility, as required. Pre-job briefings will be conducted on a daily basis during the execution of the demonstration. Hazards associated with the test area will be explained during the pre-job briefings and appropriate PPE will be discussed. The test engineer will ensure that any personnel entering the test area have the proper training and have participated in pre-job briefings prior to entering the area. Likewise, he/she will conduct post entry debriefings to collect observation concerns and opinions of entry personnel.

9.0 Pictures of Test Areas

Picture #1 above is looking North from the South end of building 601 at INTEC. There is a stake, which is difficult to see, between the ducting support structure and where the ducting enters the ground. It represents the center line of a proposed trench for the rerouting of process piping and the cutting and capping of utilities to building 601 to allow for the decommissioning of building 601.

\

Picture #2 above is from the South end of building 601 looking North. A centerline stake for the proposed trench location can be seen.

Picture #3 above is at IET. This picture shows some of the buried piping associated with an old fuel transfer station. This area will be surveyed to see if any fuel spill plumes exist.

Picture #4 above is of the old 4 rail track bed that connected IET to Test Area North (TAN). This picture is looking from IET South towards TAN. A section of this track bed will be surveyed to determine if mercury spills occurred in the past.